Notes - Wyckoff Eagle Harbor Team Meeting
March 30, 2015

These notes are not a complete record of the meeting. Instead, they are intended to capture highlights of the discussion, points of agreement, and **action items**

The team met at EPA's Seattle office. Meeting participants included:

Helen Bottcher, EPA R10
Kira Lynch, EPA R10
Rene Fuentes, EPA R10
Chung Yee, WA Department of Ecology
Ken Scheffler, CH2M HILL
Scott McKinley, CH2M HILL
Jeff Gentry, CH2M HILL

Comments on the Groundwater Reports

The team discussed agency (EPA and Ecology) comments on two draft data reports – one with results of groundwater sampling in the upper aquifer (sampling completed in May 2014), the second with results of groundwater sampling in the lower aquifer (sampling completed in October 2014). The most recent groundwater level data collected to assess hydraulic control of the upper aquifer was also discussed.

Finalizing the Groundwater Reports

Helen will look through the conclusions and findings section of the upper aquifer report and suggest to HILL how to group the findings by level of uncertainty / impact on the CSM. **HILL will develop a redline/strikeout version of both reports to address grouping of conclusion and finding statements and the questions/comments received from EPA and Ecology as described in the attachments included with the meeting agenda. EPA will then mark up those versions with any further changes.**

NAPL in the North / Deep

The team discussed CH2M HILL's recommendation for treatment in portions of the North Deep and North Shallow and Deep overlap areas. This recommendation was made in the draft data report for the upper aquifer. The team concluded that additional treatment, above and beyond NAPL recovery (which is part of Phase 1 under Alternative 7) is not warranted at this time. Highlights of this discussion included:

- There is uncertainty about the mass of NAPL in this area. In part, the uncertainty is due to differences in the methods used by CH2M Hill and Sundance to map NAPL and calculate NAPL volumes. Sundance showed a lower volume of NAPL in this area than CH2M Hill.
- There was some confusion over the boundaries and descriptions of the subareas (e.g., North Deep, compartment 2/3, North Deep / North Shallow overlap, periphery, compartment 1) in the FFS. **HILL agreed to see whether the volume of NAPL and NAPL contaminated soil by treatment area / subarea could be summarized in one master table and then referred consistently in the various sections of the FFS that describe treatment areas.** This would build upon Table 1-2 in the draft FFS.
- NAPL in the North Deep / Shallow Overlap area is over the portion of the lower aquifer that is impacted by salt water (non-potable). It is unlikely that dissolved phase contamination in this

portion of the aquifer would spread south into the potable portion of the aquifer because the groundwater flow direction is north, toward Eagle Harbor.

- The salt water intrusion extent in the lower aquifer was discussed which varies. For even the sections outside the intrusion zone, a water supply well could not produce potable water since it would pull the intrusion zone into the well. The remedial action objective for the lower groundwater zone will be modified to reflect this fact.
- Chung expressed some concern about NAPL in that portion of the site acting as a source to dissolved phase groundwater concentrations in the upper aquifer. However, the team agreed that it is difficult to predict source strength. Upper aquifer conditions will be monitored following the Phase 1 remedial action. The team expects that additional source areas may become apparent once the mass of NAPL in the core is stabilized. If NAPL in the North Deep (or anywhere else outside the core) appears to be contributing to dissolved phase concentrations above levels of concern, those areas will be targeted during Phase 2.
- The proposed NAPL recovery areas in Alternative 7 of the FFS were selected based on the thickness of NAPL with %RE>100. Actual well locations will be developed during design and the area over which NAPL will be recovered may be expanded if early recovery efforts are fruitful.
- CH2MHILL is going to inquire with Tim Olean to determine if Jet Grouting can seal the aquitard.

<u>Groundwater CSM Question 1 – timing of sampling vs. the tidal cycle</u>
In looking at all three groundwater data reports together, two questions arose that the team could not answer. First – does it matter when in the tidal cycle groundwater samples are collected? If samples are collected on an incoming tide, clean incoming water could dilute the groundwater, resulting in contaminant concentrations are that are biased low.

The team agreed that this may be important for the lower aquifer but it may be less important for the upper aquifer because the aquitard and sheet pile wall are expected to prohibit or at least significantly retard the actual movement of groundwater.

The team agreed that it is important to answer this question now, because it may impact both our understanding of the previously collected data and the design / timing of future sampling events.

CH2M HILL agreed to develop a level of effort to conduct an analysis of the lower aquifer groundwater water data, using specific conductance as a rough measure of saltwater intrusion, to see whether sample timing significantly impacts groundwater concentrations. If sample timing looks like it may be important, future sampling events will consider timing in the tidal cycle. CH2M HILL also recommends that the May 2014 upper aquifer specific conductance data also be included in the evaluation to develop a better understanding of apparent tidal effects on upper aquifer groundwater levels observed in the Gradient Report. CH2M HILL will prepare an estimated LOE to complete this evaluation for EPA review and approval prior to initiating the work.

<u>Groundwater CSM Question 2 – how “leaky” is the aquitard</u>
The team discussed the recent water level data collected from transducers in paired shallow and deep aquifer wells. This data is used to determine whether hydraulic containment of the upper aquifer has been achieved. Helen was surprised by the large daily change in water levels observed in some of the upper aquifer wells. The question is whether those variations indicate water is actually moving across the aquitard, or whether the observation is due to the pressure change in the aquifer caused by incoming and outgoing tides.

Rene was skeptical that the data indicates significant groundwater flux across the aquitard. Chung noted that in some well pairs, salinity is higher in the upper aquifer than in the lower aquifer, which could indicate salt water trapped inside the sheetpile wall above the aquitard. This would suggest that exchange across the aquitard is limited.

The team agreed that this is an interesting question and it would be nice to know the answer. However, it is not an easy question to answer and it is not critical to answer at this time. A large portion of the upper aquifer will be solidified during Phase 1 of the upland remedy. Because conditions will change so drastically, it would not be a good use of time or money to try to answer this question now.

Should sampling of the upper aquifer be repeated prior to construction?

The team discussed the timing of the next sampling event in the upper aquifer. It was noted that the recent (May 2014) sampling was the first sampling event in the upper aquifer since the construction of the perimeter wall. Because the perimeter wall so drastically changed conditions in the upper aquifer, it is difficult to compare this sampling event to the previous one. All agreed that it would be nice to have another round of data and Scott pointed out that in the third 5YR, one of the issues identified was "an inconsistent groundwater monitoring program." Another round of data could serve as a baseline against which to compare post-phase 1 data.

However, after further discussion the team concluded that it is not necessary to conduct another round of sampling prior to remedial construction since no additional data is required for the design of the remediation alternative. There is no point in establishing baseline conditions in the core area of the site for example, because after Phase 1 construction, there won't be any groundwater to sample – it will be solidified within the ISS monolith. The team agreed that it was more important to develop a thoughtful sampling and monitoring plan, to include new wells as appropriate, for the upper aquifer outside the Phase 1 ISS area. This should be developed as part of the Remedial Action Work Plan or post construction monitoring plan.

Triggers for moving from Phase 1 to Phase 2 and for switching from active to passive groundwater treatment

The team agreed that groundwater sampling results and influent into a passive drainage system will be used to determine whether additional NAPL source reduction is needed (Phase 2 of Alternative 7), and whether/when to switch from active pump and treat of groundwater outside the ISS area to passive groundwater treatment.

The recent sampling data in the upper aquifer showed lower contaminant concentrations in the upper portion (Compartment 1) and within the core area than in deeper portions (Compartment 2/3) and perimeter areas. The team speculated that this may due in part to dilution by infiltrating rain water and hydraulic containment pumping which promotes greater flushing within the core area. If true, groundwater concentrations could increase/rebound after construction of the cap. Concentrations may vary throughout the aquifer and it will be important to understand the concentrations in the groundwater where it will drain to Eagle Harbor. The team agreed that it will be important to sample groundwater near the passive groundwater collection system. It also will be important to monitor concentrations over several years post construction.

The group discussed general triggers, agreeing that specific numeric triggers cannot be developed without pilot testing. **Helen agreed to take a first cut at developing a trigger "flow chart" to be shared with the group separately from these meeting notes.**

Construction Phasing and Sequencing

The team briefly discussed the construction phasing and sequencing plan. Key items discussed include:

- When to build the cap – if we cap the whole site after Phase 1 and then have to go back and implement Phase 2, that could mean ripping up a good portion of the cap we just built. On the other hand the cap, by preventing the infiltration of groundwater, will have a substantial impact on the condition of groundwater left outside the ISS area. And, if Phase 2 involves more extraction (as opposed to ISS), wells could be installed through the cap. The initial thinking of the group is that we would be better off to build the cap sooner rather than later.
- The team agreed that replacing the perimeter wall will need to happen early in the construction sequencing, before remedial action on the beaches.
- Cleanup of the beaches should happen early – this will allow the beach material to be incorporated in the upland ISS. However, we might not want to allow that material to sit on site for long because it will smell.
- The team agreed that the option of building the new perimeter wall outside (on the beach) should be addressed in the phasing and sequencing memo, not in the FFS. Including it in Alternative 7 of the FFS would be confusing and complicate the comparison of alternatives.
- Incorporating the beach material into the upland ISS swell will increase the final site elevation and will require changes to the cap topography and changes to the storm water collection system. These details will be addressed in the design phase and not the FFS reports.

Other issues

Kira suggested the development of a risk register and provided examples following the meeting.

Input from the City (Perry) on the site grading plan is important and we should start that discussion sooner rather than later. **Helen agreed to contact the Ecology project manager for Gas Works Park to see whether she has a volume estimate on the size of Kite Hill** – this would help Perry (and the team) put the amount of material we'll need to handle in perspective.

Wyckoff OU2 / OU4 – Conceptual Triggers for Implementing Phase 2 and for moving from active to passive groundwater treatment

This memorandum identifies potential triggers to guide future decision making on the need for Phase 2 remedial action under OU2/OU4 (Upland) remedial action Alternative 7 and presents considerations for shifting from active to passive groundwater treatment at the conclusion of source area treatment.

Background

The draft Focused Feasibility Study (FFS) for the site's Upland area identifies two remedial action objectives (RAOs) that will require future performance monitoring to assess the effectiveness of Phase 1 source area treatment. These RAOs include:

- RAO 3. Prevent discharge of contaminated upper aquifer groundwater to Eagle Harbor and Puget Sound resulting in surface water contaminant concentrations exceeding the levels protective of beach play, aquatic life, and human consumption of resident fish and shellfish.
- RAO 4. Protect groundwater in the lower aquifer from further degradation. Prevent use of lower aquifer groundwater which would result in unacceptable risk to human health until restoration goals are met.

RAO #1 and #2, which are not presented above, will be achieved through installation of a soil cover, and implementation and enforcement of institutional controls that will prevent direct contact with residual soil and groundwater contamination.

Under Alternative 7, during the Phase 1 remedial action, in situ solidification/stabilization (ISS) would be used to treat the defined Core Area with gradient induced NAPL recovery occurring at targeted locations outside the Core Area. Following Phase 1 treatment, performance monitoring would be conducted to determine if RAOs #3 and #4 have been achieved. If performance monitoring confirms such, no further source treatment would be performed. If RAOs are not achieved, additional source treatment outside the Core Area would occur during the Phase 2 remedial action.

Phase 1 Monitoring and Conditions that would Trigger Phase 2

The current groundwater extraction and treatment system will continue to operate for the time being (through the design phase), with the primary purpose being maintenance of hydraulic control in the upper aquifer, which minimizes further contamination of the lower aquifer. During Phase 1, additional extraction wells will be installed in targeted areas outside the Core Area. The purpose of the new wells will be to replace extraction wells that will be demolished in the Core Area and to recover NAPL (both LNAPL and DNAPL) from areas outside the Core Area. The water treatment plant will remain in operation throughout Phase I, with upgrades as needed to effectively treat water and NAPL extracted from the expanded well network outside the Core Area.

Additional monitoring wells will be installed as needed to assess how stabilization of the Core Area impacts groundwater concentrations and hydraulic conditions. Influent concentrations to the treatment plant will also be monitored. We expect to see declining concentrations in groundwater over a period of 3-5 years after the completion of Phase 1. Concentrations will decline because:

- NAPL in the core area of the site will no longer contribute NAPL and dissolved phase PAHs to areas outside the Core Area

- NAPL recovery efforts will remove NAPL from areas outside the core. This will result in less mobile NAPL in upper aquifer soils. Removing NAPL will lower groundwater concentrations by reducing the magnitude of NAPL sources that "feed" the dissolved phase and increasing the potential for dissolved phase biodegradation.
- EAB will result in lower dissolved concentrations by degrading dissolved PAHs in areas with little or no NAPL.

Water elevations, hydraulic gradients, NAPL presence and composition, and dissolved concentrations will be measured throughout the portion of the upper aquifer that remains outside the ISS monolith. However, because concentrations are expected to vary throughout the aquifer, a particular focus of the monitoring well network will be to collect groundwater near the proposed passive groundwater collection system. "Near" is defined as at and close to the elevation from which groundwater will be collected --at the collection elevation and within a vertical horizon 5 feet above and 5 feet below the collection system and within a distance of 90 feet horizontally from the collection system.

Groundwater collected from "near" the collection system will be monitored for the presence of NAPL and for dissolved phase PAHs. What happens with that water depends on the contaminant concentrations and is summarized in the Table 1 below.

Table 1 - Phase 2 Remedial Action Triggers for Upper Aquifer

Upper Aquifer Conditions in groundwater near the passive drain collection system	Plan for treatment (if needed), discharge and monitoring	Phase 2 or other Next Steps
If there is no measureable NAPL and the dissolved phase PAH concentrations are < PRGs (Preliminary Remediation Goals for surface water on the beaches protective of both human health and the environment)	Throw a party – we're done. Discharge through passive drainage system without any treatment. Monitor effluent concentrations in the pipe(s).	No need to implement Phase 2 of the remedy.
If there is no measureable NAPL and the dissolved phase PAH concentrations are <XX * the PRGs[a]	Discharge through passive drainage system without any treatment. Monitor effluent concentrations in the pipe(s). Monitor surface water and shallow porewater concentrations around the discharge locations	No need to implement Phase 2 remedy.
If there is no measureable NAPL but dissolved phase PAH concentrations are >XX * the PRGs[a]	Treat water prior to discharge. Monitor both influent and effluent concentrations.	Consider targeted Phase 2 actions and/or extended operation of the NAPL recovery wells to treat areas that are contributing to dissolved concentrations > XX * AWQC.
If dissolved phase PAH concentrations indicate	Treat water prior to discharge.	Implement Phase 2 actions in targeted areas.

Table 1 - Phase 2 Remedial Action Triggers for Upper Aquifer		
Upper Aquifer Conditions in groundwater near the passive drain collection system	**Plan for treatment (if needed), discharge and monitoring**	**Phase 2 or other Next Steps**
continued presence of NAPL or if concentrations are increasing 5 years after Phase I is complete		
If there is measureable NAPL and/or concentrations are increasing 5 years after Phase 1 is complete	Continue to treat water in the treatment plant prior to discharge. Monitor both influent and effluent concentrations.	Implement Phase 2 in all remaining polygons

Notes:

[a]"XX * PRGs" is a placeholder. There will be attenuation, mostly via tidal dilution, between the buried discharge pipes of the passive drainage system and the point of compliance (groundwater at the sediment / surface water interface). The actual attenuation factor will be determined through field-scale pilot testing and/or tracer studies to confirm a site-specific attenuation factor.

EPA is not selecting a remedy for the lower aquifer at this time, so there are no specific, numeric cleanup objectives for the lower aquifer. A cleanup decision will be made for the lower aquifer later, in a separate CERCLA decision document. RAO 4 calls for the protection of the lower aquifer from further degradation. Monitoring data, including a round of baseline monitoring prior to the start of construction, will be collected in the lower aquifer to allow EPA to assess remedial actions in the upper aquifer to make sure conditions do not exceed the triggers defined in Table 2 below. Monitoring data will be collected both north and south of the ISS area and will include NAPL thickness as well as dissolved PAH concentrations.

Table 2 - Phase 2 Remedial Action Triggers for Lower Aquifer	
Lower Aquifer Conditions	**Phase 2 or other Next Steps**
No significant change (defined as less than 25% increase) in dissolved PAH concentrations. No lateral spreading of contaminants in the lower aquifer to wells south of the Phase I Core Area. Concentrations are stable or declining 5 years after Phase 1 remedial actions are complete.	No need to implement Phase 2 of the remedy.
Dissolved PAH concentrations in the lower aquifer have increased by more than 25% compared to pre-construction baseline conditions and/or dissolved concentrations are increasing 5 years after Phase 1	Re-institute hydraulic containment in the upper aquifer through active pump and treat and monitor to see whether that improves conditions in the lower aquifer. Consider jet-grouting in deep portions of the site and additional or other Phase 2 actions to reduce transport of contamination into the lower aquifer.

Use of current GW pump and treat system vs. passive treatment system

At some point in the future, EPA plans to switch from the current active pump and treat system to a passive drainage system that may or may not include treatment. This section of this memorandum discusses the conceptual triggers for moving from active pump and treat to a passive drainage system.

The FFS includes a conceptual design for a passive drainage system with treatment through activated carbon filters in the collection system. However, it is difficult to predict how ISS of the Core Area in Phase 1 will impact the hydrology of the site or how effective ISS and NAPL recovery will be in lowering PAH concentrations. Therefore, design of the passive drainage system will be deferred until the end of Phase 1 construction, allowing monitoring data to inform the design. Specific inputs to the design include:

- The site water balance following Phase 1 construction. The water balance will be determined after the ISS and NAPL recovery portions of Phase 1, but prior to the construction of the site-wide cap. The water balance will be based on the water levels measured after the ISS is complete and the site has had time to reach a new, stable "normal." Modeling will be used to predict the additional changes in the water balance that the cap will cause, once it is constructed.
- The target elevation for water in the upper aquifer. Water levels in the upper aquifer are currently managed, through pumping, to maintain a net upward flow of water from the lower aquifer to the upper aquifer. This minimizes the transport of dissolved contaminants to the lower aquifer. However, the remedy will solidify the most heavily contaminated portions of the upper aquifer, making the contamination in those areas immobile. NAPL recovery in other portions of the site will further reduce the amount of NAPL available for transport to the lower aquifer. Hydraulic containment will no longer be required. Water levels may need to be managed in the upper aquifer to prevent the site from flooding and to support the designated future use as a park. The target level (or range) for water levels in the aquifer will depend on the final site elevation and grading plan, which will be developed during design.
- The contaminant concentrations in the upper portion of the upper aquifer. If there is a need to drain water from beneath the cap in the future, water would be withdrawn from the upper portion of the aquifer. Currently this portion of the aquifer has lower levels of dissolved contaminants than found in deeper portions of the aquifer. However, even in the upper portion of the aquifer, the water is not clean enough to discharge into Eagle Harbor without treatment. Contaminant levels will be a key factor in determining whether / when to switch from active to passive treatment.
- The site specific attenuation factor described in the section above. The attenuation factor will be used to determine effluent limits for water discharged through the passive system.
- The ability of passive treatment to achieve the effluent limits (to be assessed through pilot scale testing).

The decision to switch from active treatment using the existing treatment plant to passive treatment will be based on the relative cost of the two systems. The cost to run the existing treatment plant is expected to be significantly lower following completion of the Phase 1 remedy, for several reasons:

- The volume of water that will need to be treated may be lowered by the ISS treatment of the Core Area. ISS will transform Core Area soils to a concrete monolith. While many of the ISS columns comprising the Core Area extend to the base of the upper aquifer, which may block upgradient and lower aquifer recharge, others do not. The effect of full depth versus partial depth ISS treatment on the upper aquifer water balance is difficult to predict.
- The volume of water potentially requiring treatment will be further reduced by the site-wide soil cap, which will be designed to eliminate (or at least minimize) surface water infiltration.
- The concentration of PAHs is expected to be lower, extending the life of the carbon beds.

- There will be less NAPL collected following Phase 1, lowering waste disposal costs.

The total impact of these changes on treatment plant operation costs is difficult to predict. Plant operations will be adjusted to meet the needs of the site during construction and further adjusted during the first 2-3 years of monitoring following Phase 1 construction. Conditions in the upper aquifer following Phase I construction will support the design of the passive treatment system (i.e., the size, configuration, and maintenance requirements for the passive treatment filters).

Treatment will not switch from the current active system to a passive treatment system until two conditions are met:

1. PAH concentrations in groundwater must be stable or declining
2. The cost to operate the passive treatment system must be substantially lower than the cost of continued operation of the active system.

The plant would not be dismantled and torn down until the passive treatment system has been operating successfully for at least 2 years.